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**RESEARCH REPORT**

**COMMITTEE: WORLD HEALTH ORGANISATION**

**ISSUE: THE IMPACT OF ATMOSPHERIC POLLUTION ON HEALTH**

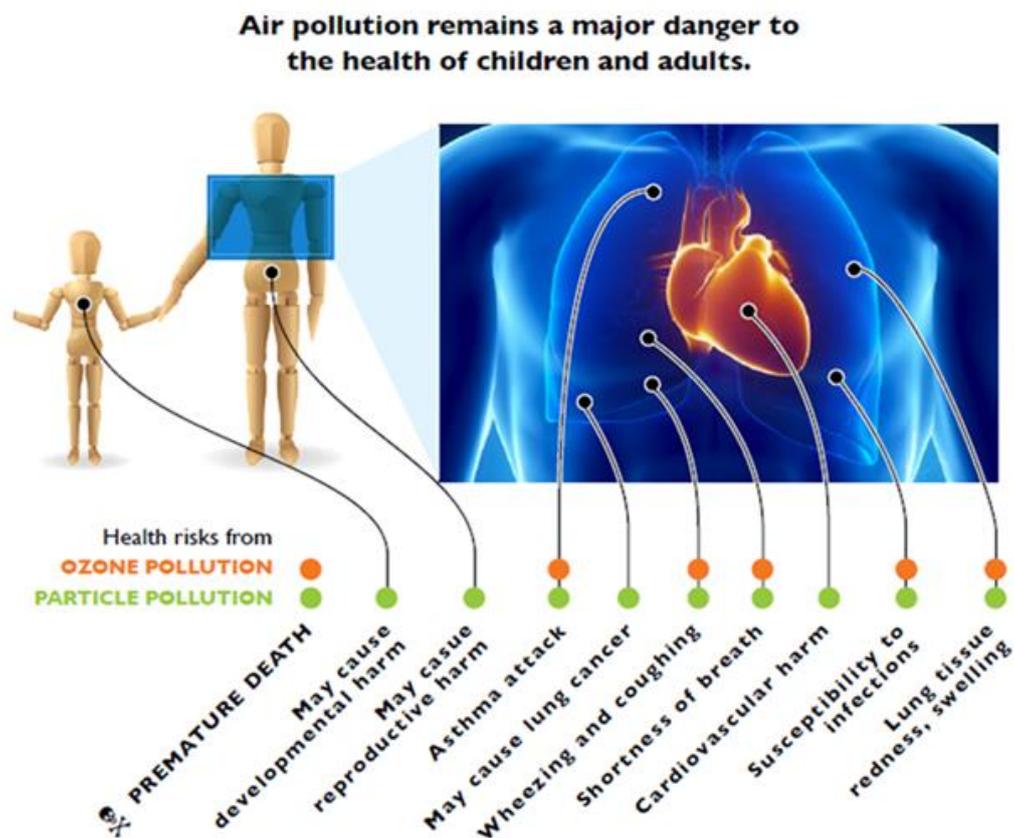
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## INTRODUCTION

Air pollution is a major matter of the 21<sup>st</sup> century because it is a worldwide problem that touches everyone, especially children under 14, elderly, pregnant women and people suffering from respiratory illness. It mainly alters the respiratory systems, lungs, throat and its tissues; but also heart and more vulnerable structure of the body like the eyes and the skin. As it may with the association with several factors trigger illnesses, it may also be the exacerbating element of a disease.

WHO estimates that some 80% of outdoor air pollution-related premature deaths were due to ischaemic heart disease and strokes, while 14% of deaths were due to chronic obstructive pulmonary disease or acute lower respiratory infections; and 6% of deaths were due to lung cancer. A 2013 assessment by WHO's International Agency for Research on Cancer (IARC) concluded that outdoor air pollution is carcinogenic to humans, with the particulate matter component of air pollution most closely associated with increased cancer incidence, especially cancer of the lung.

Ambient (outdoor air pollution) in both cities and rural areas was estimated to cause 3.7 million premature deaths worldwide per year in 2012; this mortality is due to exposure to small particulate matter of 10 microns or less in diameter (PM<sub>10</sub>), which cause cardiovascular and respiratory disease, and cancers.



## TIMELINE

- ◆ **1847:** James Young invents the process to distil kerosene
- ◆ **1865:** first successful oil pipeline put in place in New Jersey by Samuel Van Syckle
- ◆ **1872:** first significant air pollution event that caused 700 deaths
- ◆ **1948:** Donora Smog disaster, huge air pollution in Donora, Pennsylvania, which killed 20 persons and sickened 7000
- ◆ **1960's:** beginning of South East Asia's industrialisation
- ◆ **March 18th 1967:** Torrey Canyon wreck, first oil slick in History after a Liberian supertanker hit a rock. Several tons of oil were discharged off the coasts of Cornwall
- ◆ **12<sup>th</sup> to 23<sup>rd</sup> February 1979:** First World Climate Change
- ◆ **June 3rd 1979:** Ixtoc I oil spill, an underwater drill in Gulf of Mexico explodes and triggers one of the worst oil spill in the ocean
- ◆ **1980:** Asian Health Ministers Meeting is created
- ◆ **1992:** Earth Summit in Rio
- ◆ **2010:** Clearwater oil spill in the Gulf of Mexico
- ◆ **December 2014:** Lima Climate Change Conference

## KEY TERMS

**CARDIOVASCULAR DISEASE:** Cardiovascular diseases are an ensemble of disease touching heart and blood vessel alimenting all organs of the human body. Cardiovascular disease can have various effects on the body from legs' atrophy to stroke.

**RESPIRATORY DISEASE:** Respiratory diseases touch the respiratory system, including the nasal passages, the bronchi and the lungs. They range from acute infections, such as pneumonia and bronchitis, to chronic conditions such as asthma and chronic obstructive pulmonary disease.

**HOUSEHOLD/INDOOR POLLUTION:** It is the result of heating, cooking or any other domestic activity. Indeed these activities often use oil energy therefore create carbon monoxide which is known as noxious especially for foetus.

**AMBIENT/OUTDOOR POLLUTION:** It is the pollution due to industries, cars and the whole of household emissions. According to WHO, 6.7% of deaths in the world are caused by global ambient air pollution.

**GUIDELINE VALUES:** The guideline values are representing the concentrations of pollutant at which short and long term effects can occur in the body. For example, for ozone, if a quantity superior to  $100\mu\text{g}/\text{m}^3$  is inhaled in 8-hour, it would lead to short term consequences on the body.

## MAJOR COUNTRIES AND ORGANISATIONS INVOLVED

The WHO classifies 10 countries as the most affected by indoor air pollution. These countries include China, India, Ethiopia and Nigeria. Indeed 1.5 million people die every year because of atmospheric pollution. All countries are urged to take action in order to help improving air quality in those countries and more generally on the whole planet that shares the same air.

- **ASEAN** is the Association of Southeast Asian Nations. It is an economic and political alliance of ten south-eastern countries that was created in 1967. It meets in different commissions in order to solve regional issues and to have a more important weight in UN negotiations. It has been observed by China, South Korea and Japan that created the group "ASEAN Plus Three". It is involved in this issue in the extent that a Health commission AHMM, meets once in two years, and has to be active in such an issue. Asian countries are deeply concerned in atmospheric pollution since they represent the higher population density in the world.
- **India** is also deeply concerned by this issue as its particulate matter in air is 180 times higher than the WHO standards. The Yale Environmental Index gives India the 174th rank out of 178 with an indication on air quality of 23.24 out of 100. China comes in the 176th position with an indication of 18.81 in 2014. (Check out the ranking of your country on <http://epi.yale.edu/epi/issue-ranking/air-quality> )
- **OECD** is the Organisation of Economic Co-operation and Development which regroups 34 countries that consider themselves as developed countries and democracies. It includes developed European and North American countries. Originally economic, this organisation must be involved to provide resources and means to research and improvement of air quality. [www.oecd.org](http://www.oecd.org)

- **Qatar**, according to the WHO, is the second most polluted country in the world after Pakistan. Its capital city, Doha, is the 12th most polluted city in the world. Moreover, Qatar's economy is mainly based on oil production and exportation and provides almost the whole world in oil resources.
- **The United Arab Emirates** are still one of the major producers and exporters of oil in the world, and so is an economic rival of Qatar. They have one of the largest oil and natural gas stock (4% of the world oil stocks).
- **United States of America** are one of the major countries involved in such an issue as USA suffer of a dense traffic and cars emissions. They are also the home of the Environmental Protection Agency, which is implicated in human health protection and environmental cause. It has set the Clean Air Act in 1970 which puts regulation on air pollution rates.
- **Russian Federation's** major causes of death are cardiovascular diseases and cancers, which can easily be linked to a high particulate matter in air. Russian federation through the Russian's Environmental Surveillance Service has put in place a sanction to make polluters pay the amount of pollution they produce.

## PREVIOUS ATTEMPTS TO SOLVE THIS ISSUE

All over the world, a variety of index of air pollution has developed. For instance, the American create the EPA and the British, the Air Pollution Banding System. The main issue is prevention of the risks linked with pollution for the population by helping them to avoid areas of high concentrations of pollutants, in mega-cities, near highways and busy streets for instance. Of course, it is almost impossible to avoid air pollution but not practicing near those areas is a good start.

The World Health Organization, created the "Air Quality Guidelines" in order to establish a reference to population. It details the health-related assessments of different types of air pollutants, pointing out the linkage of air pollution to specific diseases, such as cardiovascular and respiratory diseases and cancers.

There have been successful policies in several sectors such as the industry, where clean technologies that reduce industrial smokestack emissions have been developed.

In transport, a lot have been done, like shifting to clean modes of power generation, prioritising rapid urban transit, developing walking and cycling networks in cities as well as rail interurban freight and passenger travel, shifting to cleaner heavy-duty

diesel vehicles and low emissions vehicle, and developing fuels with reduced sulphur content.

Finally, more and more low-emissions fuels and combustion-free power source are used and developed (solar, wind, hydropower).

## POSSIBLE SOLUTIONS

A series of actions are possible to reduce urban pollution such as fining drivers who let their engine run after a 5-minute-stop, or developing campaigns to inform better population in mega-cities and around. New technologies and sciences are also a great hope and a necessary investment into global health care. The major aim of health protection remains the reduction of greenhouse gas emissions.

## BACKGROUND INFORMATIONS

### Ozone:

#### *Sources*

Ground level ozone, which is the main component of smog often seen in cities, is difficult to control because it compounds the 6 principles pollutants.

Its genesis is the reaction of several factors.  $\text{NO}_x$  is emitted from motor vehicles, power plants and other sources of combustion. VOCs are emitted from a variety of sources, including motor vehicles, chemical plants, refineries, factories, consumer and commercial products, and other industrial sources. Though those emissions of gases are located in restricted area, the chemical reaction at the core of the development of ozone doesn't take place at those areas. Furthermore the combination with motor vehicles and stationary sources can easily help the ozone to expand in hundred-mile-areas.

#### *Effects and most concerned populations*

Scientifics pointed out that ground level ozone didn't only affect people with respiratory problems (as asthmatics) but also healthy adults and children. Exposure from 6 to 7 hours a day to ozone, even at relatively low concentrations, can make reduce lung function and induce respiratory inflammation in normal, healthy people. It also can aggravate asthma, diminish lungs capacity from 15 to 20 % due to inflammation of lungs tissues. Overall, it is a factor of developing respiratory diseases. It can be accompanied by symptoms such as chest pain, coughing, nausea, and pulmonary congestion. Recent studies provide evidence of an association between elevated ozone levels and increases in hospital admissions for respiratory problems.

The most exposed people are children because they inhale a superior quantity of air compared to adults, furthermore, they are in development and so are their respiratory system, which means they are more sensible to exterior attacks. Finally, ground level ozone problems occur at summertime when children are spending their time outside. Asthmatic children are greatly exposed because ground level ozone can aggravate asthma causing more asthma attacks, which is mortal dangerous, and so increase use of medication and visits to hospitals emergency clinics. A repeated exposure to high level of ozone can provoke permanent damages; it particularly touches outdoors workers especially in summertime.

**Guideline values:**

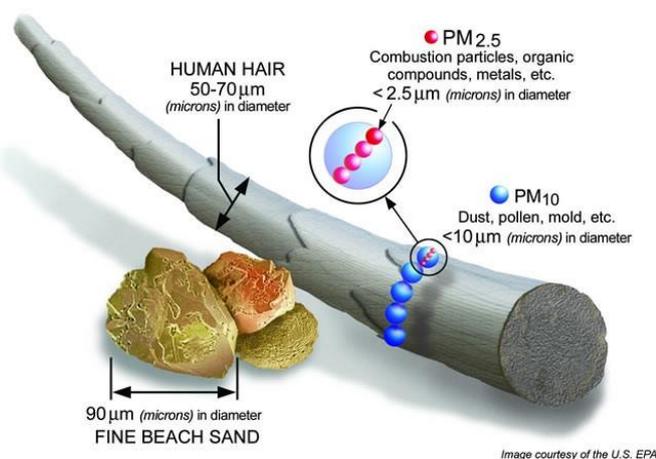
O<sub>3</sub>

100 µg/m<sup>3</sup> 8-hour mean

**Particulate Matter:**

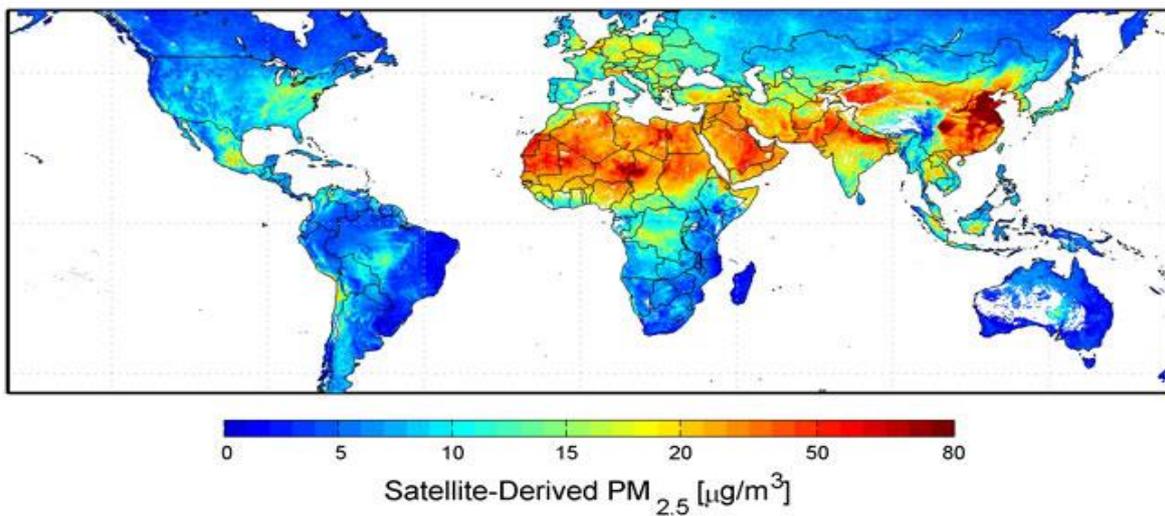
**Sources**

Particle matter is the term for solid or liquid particles found in the air. It can be large and dark enough to be seen as soot or smoke, but it can also be microscopic and only be seen with electron microscope. Finally, their composition widely vary because they originate from a variety of mobile and stationary sources (diesel trucks, wood stoves, power plants, etc.) but is mainly made of sulphate, nitrates, ammonia, sodium chloride, black carbon, mineral dust and water.



### *Effects:*

The smaller particles (PM 2.5) are considered to be the more dangerous because they are able to reach the lower regions of the respiratory system. It strongly alters breath and lung tissue and can provoke cancer and premature death. It can aggravate lung disease; increase susceptibility to lung infection and cause heart attacks and arrhythmias. It can also irritate eyes, nose and throat, make cough and cause difficulties to breathe.



This map illustrates the concentration of PM<sub>2.5</sub> in the world.

### *Guideline values:*

#### **PM<sub>2.5</sub>**

10 µg/m<sup>3</sup> annual mean

25 µg/m<sup>3</sup> 24-hour mean

#### **PM<sub>10</sub>**

20 µg/m<sup>3</sup> annual mean

50 µg/m<sup>3</sup> 24-hour mean

### **Nitrogen dioxide (NO<sub>2</sub>):**

#### *Sources:*

Nitrogen dioxide is created when fuel is burned, by motor vehicles and stationary sources like electric utilities and industrial boilers. NO<sub>2</sub> is the main source of nitrate aerosols, which form an important fraction of PM<sub>2.5</sub> and, in the presence of ultraviolet light, of ozone. It forms a strong brownish gas, and reacting with the air, forms nitric acid and toxic organic nitrates.

### ***Effects:***

Nitrogen dioxide can irritate the lungs and lower resistance to respiratory infections such as influenza. Though the short term effect on health are still unclear, repeated exposure to higher concentrations than usual can cause acute respiratory illness in children.

### ***Guideline values:***

**NO<sub>2</sub>**

40 µg/m<sup>3</sup> annual mean

200 µg/m<sup>3</sup> 1-hour mean

## **Sulphur dioxide (SO<sub>2</sub>):**

### ***Sources:***

Sulphur dioxide is formed when fuel containing sulphur (mainly coal and oil) is burned, and during metal smelting and other industrial processes.

### ***Effects and most concerned populations:***

The major health concerns associated with exposure to high concentrations of SO<sub>2</sub> includes effects on breathing, respiratory illness, alterations in pulmonary defences, and aggravation of existing cardiovascular disease. Children, elderly and people with asthma, cardiovascular disease or chronic lung disease such as bronchitis and emphysema, are the more concerned about health problems linked with SO<sub>2</sub>. Hospital admissions for cardiac disease and mortality increase on days with higher SO<sub>2</sub> levels.

### ***Guideline values:***

**SO<sub>2</sub>**

20 µg/m<sup>3</sup> 24-hour mean

500 µg/m<sup>3</sup> 10-minute mean

## **Lead:**

### ***Sources:***

Lead is mainly produced in smelters and battery plants. However, the higher concentrations of lead are around nonferrous smelters and other stationary sources.

### ***Effects and most concerned populations:***

The body through inhalation of air or ingestion of food, paint, water, soil or dust containing lead assimilates it. This is “stocks” in the bones, blood and soft tissue. It can affect the kidneys, liver, nervous system, and other organs. A long exposure to lead may cause anaemia, kidney disease, reproductive disorders, and neurological impairments such as seizures, mental retardation, and/or behavioural disorders. Even at low doses lead exposure is associated with changes in fundamental enzymatic, energy transfer, and other processes in the body. Foetuses and children are greatly exposed to low doses of lead, which may damage the central nervous system and slow growth.

### ***Guideline values:***

#### **Lead**

100 µg/l

### **Carbon Monoxide:**

#### ***Sources:***

Carbon monoxide is a colourless odourless poisonous gas formed when carbon in fuels is not burned completely. Motor vehicles, industrial processes and fuel combustion produce it.

#### ***Effects:***

By affecting blood, carbon monoxide reduces the delivery of oxygen to organs and tissue. Carbon monoxide touches especially people suffering from cardiovascular disease; at a higher concentration, it affects also healthy people. Visual impairment, reduced work capacity, reduced manual dexterity, poor learning ability, and difficulty in performing complex tasks are the consequences of CO<sub>2</sub> on the body.

#### ***Guideline values:***

#### **Carbon monoxide**

100 mg/m<sup>3</sup> 15-minute-mean

60 mg/m<sup>3</sup> 30-minute-mean

30 mg/m<sup>3</sup> 1-hour-mean

10 mg/m<sup>3</sup> 8-hour-mean

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